ALBERTA PUBLIC SAFETY SERVICES

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AGENCY INSIGHT

The 1990s: The UN Decade for Natural Disaster Reduction

You said it . . .

Thank you for the most recent copy of *Insight*, Vol. 1, No. 3

At this distance, I greatly appreciate the way in which the issues are treated, so as to put the reader "fully in the picture". The story on the chemical spill on Highway 831, for example, was backed up by an item on the type of container involved, and a product profile on sodium dichromate — I didn't even have to reach for my Canutec response guide!

Keep up the good work.

Kevin O'Kane
Senior Instructor,
National Civil Defence School
Palmerston North, New Zealand

Insight is a very useful publication and helps us to keep informed of important initiatives related to the preparation for, response to and follow-up on natural or man-made disasters in Alberta.

Rick Hotz
Public Affairs Manager, Prairies
Imperial Oil Limited
Edmonton, Alberta

As publishers of materials for the field of transportation, particularly motor carrier transport, we service customers in both the United States and Canada. We in the editorial department need all of the assistance we can get in order to keep abreast of happenings in the individual states and Canadian provinces.

For several years, we have received copies of *H.O.T.LINE* and now *Insight*. We have found both publications very helpful in keeping track of happenings in Alberta. Such publications not only keep us informed as to activities in your province, but also give us some clues as to the areas in which we can be of service to the transportation industry and particularly the motor carriers. Unfortunately, not all states or provinces provide such a fine service. Thank you for a very fine publication.

George B. McDowell
Senior Editorial Manager
J.J. Keller & Associates, Inc.
Neenah, Wisconsin

To: Bill Smith
Chief Inspector,
On Highways
Alberta Public Safety Services

We're looking forward to another safe year in 1990, and hope not to hear from you (that is, on Transportation of Dangerous Goods violations!).

Neil Campbell
Safety and Environmental Manager
Schlumberger - Canada/Alaska
Edmonton, Alberta

Insight is published quarterly by Alberta Public Safety Services (APSS). The publication aims to inform readers about current developments concerning topics which relate to the mandate of APSS: to prepare for, respond to and follow up on man-made or natural disasters in Alberta. This mandate includes activities in the areas of disaster services and management, as well as the handling, offering and transporting of dangerous goods.

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On the Cover: The United Nations has declared the 1990s as the International Decade for Natural Disaster Reduction. It is calling for concerted international co-operation for a global program to reduce the number of natural disasters, particularly in developing countries, and to predict, prevent and mitigate their catastrophic effects. Photo courtesy of Alberta Forest Service.

Alberta
PUBLIC SAFETY SERVICES

The Hon. Ken Kowalski (centre), Minister of Alberta Public Safety Services, is pictured at last year's opening of CAIR Custom Air Freight Inc., which provides door-to-door delivery of dangerous goods in full compliance with legislation.

CANADIANA

MAR 13 1990

Risk management is everyone's concern

Insight spoke with the Hon. Ken Kowalski, Minister responsible for Alberta Public Safety Services (APSS), about risk management and the public's role in emergencies or disasters.

Mr. Kowalski, we hear a great deal about risk analysis and risk management these days. It seems to be important. Is it relevant to emergency planning?

Yes, risk management is important. Like so many things these days, it is a natural development of what has been going on for some time. It is an orderly process of examining potential hazards and their consequences, then instituting programs to prevent or reduce those consequences.

I can see how this could apply to possible man-made disasters, but what about a natural disaster that you can't anticipate?

It is, of course, just not possible to know what is going to happen and when, but it is possible to study the trends over a period of time and predict the likelihood of a natural disaster. We can analyze the likely results of an event and then plan with some certainty the best way to take precautions and the best response.

Surely you need public co-operation?

Yes, you are absolutely right. In the first place, it is bound to be the public who have to react to a disaster when it actually happens. It is up to the public to take precautions in advance. This certainly does not mean that government does not have an important part to play. It is through the co-ordination of all the resources that are available to the government that a major response can be activated to help the response and recovery process. However, when disaster first strikes, the first response has to come from the individual concerned. Help then comes from that person's neighbors, next from the community and municipality, then from the Province, and finally, from the federal government.

But as I said, the very first response comes from the individuals and their families. And this is also where government has a responsibility to help. The government aims to help citizens prepare for any emergency so that every family has a disaster plan that is properly prepared and regulary rehearsed. We help to do this by getting relevant information out to the public so they know what to do. Information is one very important part of any risk management program.

Your comment about every family having a disaster plan is an interesting one. Do you really want every Albertan family to have its own disaster plan?

Yes. Of course, I do not want every family to spend long hours preparing for some event that could not happen here. Alberta can't have a Tsunami, but it can and does have tornadoes, floods, and severe summer and winter storms. Schools regularly practise fire drills, and we would think them very remiss if they did not have them. But how many families have fire drills? How many families have an emergency supply of food, clothing, flashlights? The list can go on and on. What I want is to encourage the public to think about this possibility, seek advice and help, talk to their local municipal council, talk to APSS, and at least make some preparations now. And I mean now.

If risk analysis will help to identify potential risk areas, then is it something that every Albertan should take very seriously?

Yes, we all need to use every tool that is available to help ensure the safety of everyone who lives in our province. I really believe that the development of risk analysis will help us all, and I am very satisfied that Public Safety Services now have a small, but special group to report to me on this whole field of study and how it will impact on the work of the agency. It is time to bring more science into the process.

New $20 fee outside Alberta

To all subscribers outside Alberta:

Starting with the next issue of *Insight* (June 1990), there will be a mailing and handling charge of $20 for four issues. This charge will apply to all copies sent outside the province of Alberta, Canada.

Everyone receiving *Insight* in Alberta will continue to receive their copies without charge. No further action is required from them.

If you receive your copy of *Insight* at an address outside Alberta, you will continue to receive it only if you return the back page of this issue, or a photocopy, to the address listed on page 2, along with a cheque for $20.00 (Canadian). Please make your cheque payable to the Provincial Treasurer of Alberta. Unless we receive the completed form before May 31, 1990, we will have to remove your name from our mailing list.

We regret this action, but there is no alternative.

Insight has an ever increasing mailing list. There are just not enough funds to provide copies to everyone unless we can recover some of the costs involved in producing this publication.

Please feel free to call me if you think that this decision will adversely affect your work. My telephone number is (403) 451-7111.

Grahame Blundell
Director, Communications
Alberta Public Safety Services

Science helps take out the guesswork

This issue of *Insight* focuses on the theme of risk management, starting with an informative article by Dr. John Shortreed, the associate director for the Institute for Risk Research at the University of Waterloo in Ontario, and one of Canada's main experts on the subject.

On the industrial front, Art O'Connor of The Canadian Chemical Producers' Association discusses how his organization incorporates comprehensive risk assessment and management in its world-renowned Responsible Care program.

From Ottawa, Michael Salib, Executive Director of the Major Industrial Accidents Co-ordinating Committee (MIACC), writes about the draft report MIACC is preparing to help municipalities use risk assessment to prevent a major accident from occurring in their communities, and how to reduce the effects if one ever happens.

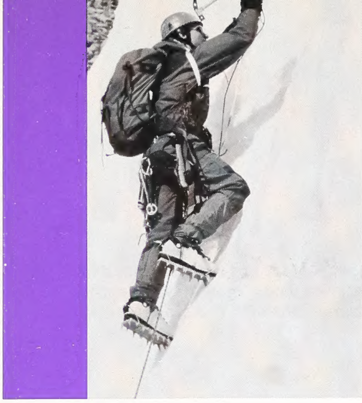
Several articles discuss how Alberta Public Safety Services (APSS) is using risk management. APSS is very much in the business of risk management through its two programs: disaster preparedness and response, and dangerous goods control.

A new initiative at APSS is introducing a more rigorous approach to its business by applying more of the formal techniques of risk management. Ralph Holmes, the APSS Industrial Programs Co-ordinator, has been given the task of advising and assisting all branches of APSS with risk management techniques. In this issue, Mr. Holmes writes about the sometimes baffling way the public perceives risk, and also discusses the APSS Transportation of Dangerous Goods Program as a risk management program.

Other articles include an unusual and rare program at the University of Alberta which aims at producing "safety crusaders" for tomorrow's management teams.

Staff Matters

John Patrick Piché joined the Disaster Field Services Branch in Edmonton on Dec. 1 to begin a two-year project as a District Officer to help develop disaster preparedness and emergency response on Indian reserves in Alberta. The project is a joint venture between Alberta Public Safety Services and the federal Department of Indian Affairs and Northern Development. Mr. Piché, a Treaty Indian from Cold Lake, was formerly a CBC radio announcer in Yellowknife.



One's choice of leisure activities can increase the risk of "premature" death.

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Risk Management in a Technological Society

by John Shortreed, Associate Director
Institute for Risk Research
University of Waterloo

The risks, benefits and costs of technology must all be balanced by Canadian society. Risk management is a group of methods and techniques for helping society make these trade-offs. The mission of the Institute for Risk Research at the University of Waterloo in Ontario, which has members across Canada, is "to help people understand risk".

Risk is the probability of loss. The loss of life or quality of life is of primary concern, followed by environmental and property damage. We will all die eventually, so risk is the chance of "premature" death.

Risk management is not "free": we must give up our labor and other resources to reduce risk. This means that to reduce the probability of premature death, we must give up some of our life's time with 100 per cent certainty. Moreover, if we "live it up" on weekends with activities such as skiing, boating, camping and travel, we place ourselves at risk in order to live. Risk management is the process of trading off life for the probability of death.

What has this to do with emergency response and disaster planning? The answer is effectiveness and efficiency through risk management. How effective is the use of our life's labor in reducing risk and how efficient is the expenditure of this scarce resource? Usually, we express the life's labor resources in terms of dollars of expenditure.

Saving as many lives as possible

Every $40,000 to $60,000 represents about one year of life's labor. Many cancer screening tests can save a "premature" death for about $20,000 to $30,000, or one-half a year of life's labor. Crash fire rescue at Canadian airports has been estimated to cost about 140 years of life's labor for every life saved. Should society consider doing less crash fire rescue and more cancer screening with an associated benefit-to-cost ratio of 280 lives of labor to one? How should the decision be made?

Consider a typical urban fire department in Canada. Conventional wisdom says that there should be about one firefighter for every 700 to 1,000 people. Risk management says that society should periodically re-evaluate the lives saved, at what cost and make adjustments on that basis. Advances in building construction, smoke detectors, firefighting equipment and other duties of firefighters must all be considered.

Why bother with risk management?

Risk management is not an easy task. Consider, for example, possible reductions in the number of firefighters. What tasks would not be done? How many lives would be lost? Uncertainty in making the estimates will be considerable, but the answer is not: "We can't afford not to spend the money," since the same money may save more lives elsewhere.

How do fire departments, disaster services, health services and safety regulators practise risk management? Is it really practical to implement the concept of saving the most lives possible? The answer is yes, and the reasons are effectiveness and efficiency. For example, fire departments can be more safety effective by expanding their services to include medical emergencies and the capability to respond to dangerous goods incidents and major industrial accidents.

Safety services can become more efficient by improved training methods, more use of technology, better co-operative arrangements with other resources, optimal allocation of efforts between prevention, response and mitigation, utilization of computers for information and enforcement, and so forth.

These examples of improved effectiveness and efficiency are typical of many recent developments in Canada, and many of them are described in detail in this issue of *Insight*. Many organizations are now doing risk management implicitly, if not explicitly. Some would say, "Well, risk management is just common sense. Moreover, it requires resources,so therefore why bother doing risk management? Let's spend the money where it will save lives."

Risk management is a *management* function with the objective of safety. Like any management function, it involves setting objectives, sizing up the existing situation, generating alternatives, evaluation, decision mak-

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Risk management for fire departments and other safety services means saving the most lives possible with the money available.

ing, implementation and monitoring of progress. It also includes limiting the management task to the most efficient and effective level.

Getting started

Risk management alternatives can be classified into five techniques for reducing risk: (1) ban the hazard, (2) prevent accidents, (3) protect people, (4) respond to accident events, and (5) treat the damages. The objective is to get the mix that will most efficiently reduce risk to a "tolerable" level.

Some hazards such as floods and earthquakes cannot be *banned*, but explosives, crack, speeding and other hazards can (although not always successfully).

Training, reduction in on-site quantities of dangerous goods, backup systems, inspection, enforcement and licensing can all be used to *prevent* fires, major industrial accidents and other releases of hazards.

Given the release of a hazard, the use of "crash-proof" containers can *protect* people from the hazard. Similarly, buffer zones can remove people from the hazard. (Note the article on buffer zones on page 11.) Protective suits can limit exposure of emergency personnel, who are most at risk.

Response to an incident can reduce risks by rescue, evacuation, knocking down toxic gas, cooling nearby tanks, etc.

Insurance, victim compensation, environmental cleanup, hospitals, health care and economic assistance are all methods of *treating* the damages to mitigate the risk.

A practical approach to risk management

Step 1 in doing risk management is to look at the "residual risks" and the current risk reduction activities. This will give an overview of how effective the organization is in managing risks. For example, one organization in Canada found that 80 per cent of its residual risks were associated with accidents, while 100 per cent of its risk reduction efforts were for chronic health concerns. Its first decision was to allocate 50 per cent of risk reduction efforts towards accident prevention.

In examining risk reduction activities, it is essential to look at the effect that regulations, licences and enforcement have on the risk. For example, it is not uncommon to have compliance levels of much less than 50 per cent. The cause of the accidents may well be directly related to the regulation, but if no one is complying with the regulation, then there is limited impact on accidents. Overregulation is one of the most common problems found when beginning risk management.

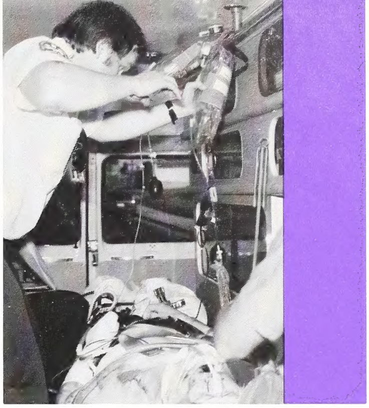
Residual risks and their root causes are usually estimated from historical data. Typically, existing data must be organized and carefully analysed to determine the root cause of accidents. For example, in a recent study on scuba diving risks, it was found by organizing 18 years of data on deaths and serious injuries that more than half of all such accidents involved dives deeper than 80 feet, and almost 100 per cent of accidents involved inexperience or lack of training. These deep dives represented only about five per cent of all diving activity. After this analysis, an information program was identified and it had a very high level of effectiveness in terms of cost per life saved.

Exercises such as this help people consider activities in a different way, with a different mind set. By looking at accident data, and tracing the link between existing activities and expenditures to find the root causes of accidents, the need for immediate changes in some procedures often becomes apparent.

Step 2 in risk management is to consider all five ways of reducing risk previously listed, and for each one, itemize all possible ideas for reducing risk. Often, a check list or a systematic tracing through the operations, accident and risk sequence can turn up solutions not previously considered. Many of these alternatives can be immediately dismissed as too expensive, impractical or ineffective, but many new ideas will remain. The list should contain all of the existing activities.

In **step 3**, the list of potential risk reduction activities can then be ordered according to their effectiveness in terms of cost per life saved, or cost per serious accident prevented. Decisions can then be made on revisions to existing activities. Usually, about 70 to 80 per cent of existing activities are confirmed by the analysis. However, the changes in activities represent a real gain in safety as more effective actions are introduced. This is the life-saving payoff for risk management.

Step 4 is the monitoring of the results of the changes. How good were the cost estimates and the estimates of risk reductions? Many systems are



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A recent study shows that for every taxpayer's dollar spent on activities to prevent or reduce the impact of disasters, three more are saved.

very safe, and identifying measures of effectiveness can be a real challenge.

Obviously, risk management is more complex than described in this short article — but not much. Additional issues of risk perception, lack of data, risk communications, high levels of uncertainty, etc. do provide some difficulties, but the basic steps often return major safety gains with reasonable effort. The payoff is lives saved, and is well worth the effort.

APSS activities prove their worth

by Ray Langman, Executive Director
Disaster Services

Ed. Note: One of the objectives of the risk management process is to dedicate resources where they will do the most good. Alberta Public Safety Services has recently begun a validation program to determine the benefits of some of its risk management activities. It is planned to complete this series of validations during the next two years.

In the private sector, businesses usually have a very simple but effective way of measuring their cost-benefits: it's called the profit margin. Governments usually do not have such a direct yard stick of performance, and it is difficult to show in an objective way that the taxpayer is getting value for dollars spent.

With this thought in mind, Alberta Public Safety Services (APSS) undertook two validation studies of some of its activities to analyse their cost-benefit ratios. The results of these analyses have been quite positive, showing cost-benefit ratios of 3:1 and 4:1. In other words, every dollar of taxpayers' money spent helps save three or four dollars through APSS activities which prevent or reduce the impact of disasters.

The studies, which were undertaken with financial support from Emergency Preparedness Canada under the Joint Emergency Preparedness Program, were done by Dr. Jim Byrne of the Pass Group, an Ottawa-based consulting company, and focused on the Disaster Health Services and Disaster Field Services Branches of APSS. Dr. Byrne used the Delphi modelling method, a technique developed by the Rand Corporation in the United States in the 1960s to study topics where there is knowledge but little available data.

In the Delphi method, a number of participants knowledgeable in a particular field are asked to evaluate, rate or rank, and comment on a series of value questions. The results of this first survey are evaluated and the evaluation is circulated to the same participants to try to attain a concensus, or at least, convergence of opinion. A second iteration of the process may be necessary. The results of such a survey give a first approximation of the true value of a service. Also, the results, although not precise, lead themselves to statistical analysis so that bounds of probability add credibility.

The latest study, completed last year, analysed the main activities of the Disaster Field Services Branch. These were stated as "to assist all municipalities, industry, community groups and other agencies in developing emergency plans and programs to improve local capabilities to respond quickly and effectively to emergencies or disasters, and to assist local officials with their emergency preparedness activities."

The study focused on the peacetime costs and benefits to the Government of Alberta. The costs and benefits to municipalities were not considered. The timeframe of analysis was the fiscal years 1982-83 to 1986-87, but elements of the 1987 Edmonton tornado experience were considered.

The results of this analysis show that the benefits to cost ratio is 4.3 to 1, with a probable accuracy of +/- 30 per cent. That means that even on the low end of the estimate, the benefit is 3.1 to 1, or that for every one dollar spent, at least 3.1 dollars are saved.

The Canadian Chemical Producers' Association has set a world example with its Responsible Care program to promote safety in the industry.

Managing risk through "Responsible Care"

by J. Art O'Connor
Vice-President, Public Affairs
The Canadian Chemical Producers' Association

Ed. Note: The Canadian Chemical Producers' Association (CCPA) and the nuclear power industry have introduced the most comprehensive risk management programs of any industry associations in Canada. The CCPA Responsible Care program differs from the nuclear power industry program in that it is a voluntary, rather than regulatory program, although it is internally a condition of membership in the association.

More than 10 years ago, The Canadian Producers' Association (CCPA) developed a set of guiding principles which were circulated among its member companies in a document titled *Statement of Policy on Responsible Care.* These guidelines essentially described the practices which would provide the industry with the assurance that it was operating in a responsible manner with respect to its health, safety and environmental performance.

Formal endorsement of these principles was made a condition of CCPA membership in 1984. By 1989, the board of directors had approved the last of a series of codes of practice to provide more specifics to its membership.

The first code to be produced dealt with community awareness and emergency response, and it permeates the remaining codes. Five additional codes cover research and development, manufacturing, transportation, distribution, and hazardous waste management.

Risk assessment and risk management become critical elements in the implementation of the codes. In the research and development process, the code requires that protocols and methodology be in place to identify and evaluate health, safety and environmental hazards. This requirement flows through the research and development process from the project approval stage to the market introduction of a new chemical, chemical product, process or application of the product.

On an even broader scale, CCPA member companies are required to have an active community awareness and emergency response (CAER) program at each of their sites. This includes research and development, distribution and waste treatment sites.

Fundamental to the site plan is a risk assessment program to identify and evaluate the potential impact on the site or the community of an incident at the site. The CAER code carries a responsibility for this assessment of risks and associated hazards to be communicated to employees and the surrounding community. Such assessments are critical to reducing the potential for a site-based incident and in the preparation of site and community emergency response plans.

This approach also carries into the transportation area, where identification and evaluation of the hazards and risks associated with the movement of chemical products is critical. Such assessments are vital to the company's selection of mode, equipment and routes.

There is probably no function within the life cycle of chemicals where risk assessment is more essential than in manufacturing. Its related code of practice addresses the design and construction of facilities, plant operations, and protection of the employee, community and environment. Member companies are required to perform and document a hazard analysis and risk assessment during the *design* stage of any facility as a precursor to minimizing and controlling hazardous situations.

There is also a requirement to establish site selection and buffer zone criteria and to address the phases of start-up, operations and decommissioning. The manufacturing code specifically identifies a requirement to perform and document a regular hazard analysis and risk assessment throughout the *operating* life of the facility. It also requires actions to minimize the identified risks.

In the distribution phase, member companies are required to regularly identify and evaluate risks related to the storage and handling of chemicals and chemical products whether they are on owned or contracted premises. Member companies are also required to provide information to employees and contract personnel with respect to the hazards and identified risks associated with all facets of the functions performed at the distribution site.

The same requirements exist for periodic risk assessments of the operation of hazardous waste facilities. Periodic assessments of safety, health and environmental hazards and risks are also required under the code dealing with hazardous waste management. These assessments are an essential input into the development of emergency response plans for the site, as well as for risk reduction programs.

A hazard analysis and risk assessment is required for siting, design, construction and commissioning of waste treatment facilities. There is a requirement similar to that of the manufacturing code for buffer zones, and decommissioning of the site.

All of the codes of practice are founded on a fundamental principle of ensuring that member company operations do not present an unacceptable level of risk to employees, customers, the public or the environment. Critical to achieving this goal is the identification and evaluation of hazards and their associated risks. These steps are precursors to decisions and practices aimed at reducing risks, and developing contingency plans and communications for inside and outside the organization.

Member companies of the CCPA have now been asked to reaffirm their commitment to the original guiding principles in their word and spirit as embodied in the codes of practice. They are being asked to go even further in providing a series of implementation target dates for full compliance with the codes.

The Responsible Care approach was conceived within the CCPA as a Canadian solution, but has had a far-reaching influence on a number of its peer organizations outside Canada. The major chemical trade associations in the United States, Great Britian, Australia and New Zealand have all adopted the term and CCPA symbol and are in the process of developing their own domestically based programs. It is expected that other associations in Europe will follow. Canada has led the rest of the world in this voluntary approach to fulfilling its environmental responsibilities.

Upcoming Courses

The Alberta Public Safety Services Training School offers a wide variety of courses in disaster and emergency planning, preparedness and response, as well as training for carriers and shippers of dangerous goods (provincial employees). Courses include Emergency Site Management, Rescue Leaders, Emergency Public Information Officer, Municipal Disaster Services Program Management, Disaster Social Services, Dangerous Goods Orientation, and Disaster Health Seminar.

For further information about APSS Training School courses, contact the Director of Disaster Services in your municipality, or Scott Bricker, Director of Training, Alberta Public Safety Services, 10320 - 146 Street, Edmonton, Alberta T5N 3A2, (403) 422-0346.

MIACC works on risk assessment for municipalities

by Michael Salib, Executive Director
Major Industrial Accidents
Co-ordinating Committee

Ed. Note: The Major Industrial Accidents Co-ordinating Committee (MIACC) was established in 1987 to address the issues raised by the Environment Canada study, *The Bhopal Aftermath Review: An Analysis of the Canadian Situation.* This study found that the potential existed for a major industrial accident in Canada, and made 21 recommendations about how such an accident could be prevented, or its effects reduced. The recommendations were found to cut across all jurisdictional lines, and MIACC was formed as a co-operative body to deal with them.

The Major Industrial Accidents Co-ordinating Committee (MIACC) is a national body whose mission is the promotion of excellence in prevention, preparedness and response programs to reduce the risk of major industrial accidents involving dangerous substances. It also promotes uniformity in the implementation of these programs and guidelines across the nation.

MIACC has established several working groups that address issues of concern to its stakeholders. One such example is the working group charged with the production of risk assessment guidelines for Canadian

Experts from across Canada are developing guidelines to help municipalities prevent and prepare for major industrial accidents.

municipalities. This working group has developed a draft report entitled *Guidelines for Municipal Risk Assessment for Major Industrial Accidents,* which was presented at the MIACC annual general meeting in November 1989. Although the report is not complete and much work remains to be done, a brief review of the group's progress is presented here.

Developing guidelines

The objective of this group is to produce guidelines that will assist Canadian municipalities in achieving public protection from the effects of major industrial accidents by enhancing their capability to perform effective risk assessments. Municipalities have the responsibility of protecting life, health, property and the environment. This entails maximizing the reduction of risks with the resources available.

The result of MIACC's work will assist municipalities in making decisions on the allocation of expenditures for safety resources where they will be most beneficial. The implementation of a risk management program by a municipality will provide a means of measuring the expected improvements in safety in relation to expenditures and resource allocation. Risk management also provides the means of generating alternative safety measures. It comprises several components, one of which is risk assessment.

Vulnerability and risk

A key concept in risk assessment is the difference between vulnerability and risk. Vulnerability considers all possible circumstances that can affect a potential accident. In the case of a toxic gas cloud, one dimension of vulnerability is the direction of the wind. In the planning stage, the direction of the wind is unknown, other than the prevailing one so therefore, all possible wind directions must be considered. The vulnerable area must take into account a large area in which risk is possible under any or all combinations of events. This, in turn, means that emergency plans addressing evacuations should consider the worst possible scenario — "better safe than sorry!".

Risk is the probability of death (or physical injury, property loss or environmental impairment). For major industrial accidents involving dangerous substances, risk is the probability of a release and the formation of a toxic gas plume. Within this plume, there is the minimal lethal dose, which is defined as the level of toxic gas sufficient to cause death to the most susceptible person in the population.

For example, for chlorine gas this level is about 500 to 800 parts per million for a period of 10 to 15 minutes. The report, however, errs on the side of caution and sets the risk value for chlorine at 300 parts per million, which is 10 times the value considered Immediately Dangerous to Life and Health. Contingency plans must cover all vulnerable areas as they are of interest to emergency responders, although when a release occurs, only one part of the vulnerable area will be at risk and will be the focus of response.

Risk assessment is divided into two major parts. First, there is risk analysis, which consists of defining the scope of the risk, then identifying the hazards involved and finally estimating those risks. The second task is risk evaluation, which takes into consideration the social, economic, environmental and other impacts of the risks.

Steps to risk assessment

The risk assessment guide under development recommends using the following steps:

Risk Selection This includes the identification of hazards within a municipality. This may be accomplished through various routes, for example, by surveys of local industries, analyses of shipments of dangerous goods, consideration of water treatment plants, etc. Once existing hazards have been identified, then the substances and threshold quantities should be ranked by priority and selected for risk assessment.

Risk Estimation This involves determining the explosion and toxic gas risks, plotting the areas at risk on a map, estimating the population at risk, aggregating the risk data over the areas at risk, and finally, estimating the probability of occurrence.

Risk Evaluation Risk estimates for all locations in a municipality should be assembled on one chart. These estimates can be evaluated by comparing them to other risks in the municipality or against some standards of tolerable risks, unacceptable risks and risks that require management.

Risk Management This is mainly the consideration of alternative means of reducing the previously assessed risks. Such means may include ban-

MIACC is recommending all provinces and territories place buffer zones around hazardous developments to reduce the effects of any accident.

ning certain activities, establishing buffer zones, reducing stored and transported quantities of dangerous substances, etc. These means should be evaluated for their effectiveness in reducing risk. A number of these alternatives may be implemented until it is judged that the risk has been reduced to a "tolerable level".

Risks uncertain

An important fact to keep in mind is that risk, by its very nature, is uncertain. Risk analysis estimates typically have accuracy ranges of 1/1,000 to 1,000 times the estimated value. There is also a tendency to overestimate the level of compliance, the effectiveness of the emergency response capability and other human and organizational techniques of risk management. However, there is no way around this limitation since most of the uncertainty is part of the reality of risk itself.

At the MIACC annual general meeting, delegates made some recommendations to the draft guide, and during the next year, the working group will be simplifying and refining the guide.

MIACC adopts buffer zone report

The provinces and territories are being urged to authorize buffer zones around hazardous developments. This was the major recommendation of Working Group No. 5 approved at the MIACC annual meeting in Toronto on November 29-30, 1989.

MIACC — the Major Industrial Accidents Co-ordinating Committee — was established in 1987 to work towards preventing a Bhopal-type of incident in Canada, and includes senior representatives from federal and provincial government departments, industry and other interest groups.

All provincial municipal affairs departments participated in the preparation of the buffer zone report, under the leadership of Tom Forgrave, Assistant Deputy Minister of Alberta Municipal Affairs, and Rae Runge, Executive Director of the department's Planning Branch. The report calls on all provinces to ensure that legislative authority exists for the appropriate regulating authority to establish buffer zones. To assist the regulating authorities, the report also proposes a national agency to develop guidelines for risk assessment.

MIACC members agreed to lobby their provincial or territorial governments to enact the necessary legislation. The Steering Committee Chairman has made the request to municipal affairs ministers responsible for land use planning legislation.

The imposition of buffer zones does not mean that land will be sterilized. "The idea," says Mr. Forgrave, "is to limit the exposure to risk by making sure that only low density developments are located in risky areas."

Work will continue in the coming year on describing appropriate land uses for buffer zones and considering how they could be applied around existing developments. The group will also be working with other MIACC groups on risk assessment and the development of a communications program.

"What is being proposed here is essentially not much different than the existing airport vicinity protection area process," notes Mr. Runge. However, the working group believes that people generally need to be convinced of both the need for and usefulness of buffer zones.

"When you consider that in 1986, one of every 1,500 Canadians was evacuated for protection from gas or chemical situations, and one release a day occurred," Mr. Forgrave says, "the justification for early action on buffer zones should be apparent."

The adoption of the report was the first time MIACC has adopted action recommendations other than for its own operations.

Alberta legislation helps promote the safe transportation of dangerous goods through such things as driver training and safety inspections.

Hazard Management in the Dangerous Goods Control Division

by Ralph Holmes, Co-ordinator
Industrial Programs

The mandate of Alberta Public Safety Services (APSS) is centered on loss prevention, a term describing activities carried out to prevent or minimize any form of threat to people, property or the environment.

Threats are presented in the form of hazards. A hazard is a situation that has the potential for human injury, damage to property, damage to the environment, or some combination of these events. The majority of activities at APSS are focused on natural hazards and technological hazards. Natural hazards include those associated with severe weather conditions and other naturally occurring events; technological ones are directly related to technology or production, such as chemical releases, transportation spills or accidents, industrial process failures, fires and explosions. More than one type of hazard can be present in a single incident.

Risk Assessment Phase

Anyone analysing the threat posed by a hazard must determine the likelihood and frequency of an incident occurring, and the extent of the consequences, which might include the release of a toxic gas cloud, fire, explosion, blast wave, or missiles. The next step is to consider these consequences and look at those vulnerable areas at risk in the vicinity of a possible occurrence. These risks include acute, delayed and chronic harm to life, permanent, repairable or temporary damage to property, and/or permanent or recoverable damage to the environment.

Hazard Management Phase

Once the risk analysis has been completed, the focus now proceeds to hazard management. There are four aspects to hazard management: mitigation or prevention, preparedness, response and recovery.

Prevention activities are those which eliminate, reduce or mitigate the impact of an occurrence. They consist of efforts undertaken in a planned, economical and orderly fashion. Prevention also includes risk reduction activities to eliminate or reduce the probability of an occurrence, and long-term activities to reduce the effects of an unavoidable disaster.

Preparedness activities are necessary when mitigation measures have not, or cannot, prevent a disaster. They include the preparation of emergency plans to provide for the protection of life and to minimize the disaster damage. Resources necessary to enhance the response to disasters are also identified and put into place at this stage.

Response activities must be well organized to bring the incident under control and to provide emergency assistance to those affected by the disaster. They must also reduce both initial and secondary damage and pave the way for speedy recovery operations.

Recovery operations provide the resources needed until all systems return to normal. Short-term recovery operations are designed to return vital systems to minimal operating standards as soon as possible. Long-term recovery is designed to return conditions to normal or improved levels.

Dangerous Goods Control Division

The Dangerous Goods Division at APSS is responsible for the administration of the Transportation of Dangerous Goods Control Act, which promotes public safety and loss prevention. The Act includes requirements developed as a result of lessons learned throughout a number of years.

These requirements, which are found in similar legislation around the world, have been implemented as the result of accidents that involved the loss of life and/or severe property damage. Enforcement activities are carried out by the division to ensure that those persons handling, offering for transport or transporting dangerous goods are complying with the standards set by the legislation.

Prevention efforts contained within the legislation include specific prohibitions; certain goods are not allowed to be transported, for exam-

Drivers of dangerous goods must carry shipping documents about their cargo so first responders know what hazards they face if a spill occurs.

ple, or their quantities might be limited during shipping. There are also special provisions, such as requiring the manufacturers of extremely dangerous goods (e.g. chlorine) to have an emergency dangerous goods plan to assist a community in the event of an accident. Also included are provisions for dangerous goods transportation routes. Other prevention measures in the legislation set safety standards and safety requirements, including special training for people transporting dangerous goods.

Preparedness aspects of the legislation are intended to save lives and to minimize damage in the event an accident does occur. They also seek to provide for better response activities. The safety marks, which include required labels and placards, along with the shipping documents, help make first responders aware which dangerous goods are present and their hazards. The legislation requiring the driver involved in a dangerous goods incident to report immediately to the nearest police department is another measure intended to protect life, health, property and the environment.

Response requirements in the legislation that will provide assistance to the emergency response effort include training and emergency response assistance plans. Other assistance provided to the response community by APSS include the information support from the Compliance Information Centre and the on-scene assistance of a designated dangerous goods inspector.

As technology advances and more information is obtained from the reports which companies are required to send to Transport Canada within 30 days of a dangerous goods incident, accident trend analysis will reveal any shortcomings of the legislation. Changes can then be made to the legislation as needed to provide for a higher degree of public safety.

Dangerous goods instructors' course

The next accreditation courses for dangerous goods instructors will be held from May 14-17 at the Northern Alberta Institute of Technology (NAIT) in Edmonton, and May 7-11 at the Southern Alberta Institute of Technology (SAIT) in Calgary.

The course, which began in 1988, is designed for dangerous goods instructors who train people in the safe handling and transportation of dangerous goods. To receive accreditation, participants at the course must pass an examination administered by NAIT or SAIT. The accreditation program is voluntary, and is intended to help standardize training for carriers of dangerous goods.

The instructors' course is held at various times throughout the academic year. For further information, contact Harold Hayter, Manager, Training in Business and Industry, Division of Continuing Education, NAIT, 11762 - 106 Street, Edmonton, Alberta T5G 2R1 (phone 403-471-7584; or Chemical Technologies Department, SAIT, 1301 - 16 Avenue N.W., Calgary, Alberta T2M 0L4 (phone 403-284-8592).

Make a note . . .

HAZTEC Canada Eastern Toronto '90

May 15-17, 1990. HAZTEC Canada will provide information to individuals involved in environmental control and hazardous waste management. The conference will be held at the Toronto International Centre in Mississauga, Ontario. For more information, contact: HAZTECH Canada #260, 4936 - 87th Street, Edmonton, Alberta, Canada, T6E 5W3, telephone (403) 466-6622, or fax (403) 469-1398.

HAZTECH Canada Western Calgary '90

Call for papers on the topic Environmental Control/Hazardous Waste Management in the '90s. Deadline for submission is June 15, 1990. The conference will be held in Calgary on Nov. 6-7. For further information, contact: HAZTECH Canada, #260, 4936 - 87 Street, Edmonton, Alberta, T6E 5W3, telephone (403) 466-6622, fax (403) 469-1398.

7th International Hazardous Material Association Conference

June 19 - 22, 1990. This year's conference is called Haz Mat in the '90s: Are You Ready? and will be held in San Jose, California. For information, contact: Conference Manager, Preferred Meeting Management, Inc., 640 East Wilmington Avenue, Salt Lake City, Utah. 84106, telephone (801) 466-3500.

Risk management is an implicit part of Alberta Public Safety Services' role in helping municipalities develop plans to deal with disasters.

GOV'T OF ALBERTA

Risk Management in Field Services

by Ken Morris, Director
Disaster Field Services Branch

Risk management is an implicit part of most activities carried out by the Disaster Field Services Branch at Alberta Public Safety Services (APSS). While individual municipalities remain responsible for risk management and reduction, as well as preparing for and responding to disasters and emergencies, the branch can help point out risks and what to do about them.

The branch's primary role in this area is working with municipalities to develop their emergency plans, an activity that helps prevent accidents as well as reduce their impact through prepared, swift and effective response. Each municipality in Alberta has its own disaster services agency, including one or more members of the local council, and a director of disaster services, who acts as the direct contact with the APSS district officer. The field services district officer works from a basic model emergency plan developed by APSS, and in conjunction with the local director, adjusts and customizes it to fit the needs of the community.

An important stage in developing the plan is a hazard analysis, where the district officer, the disaster services director and local fire chief identify all the hazards, including industrial ones, throughout the municipality. The hazards are analysed and ranked according to priority. The process points out areas where the municipality can pursue measures to reduce risks, and details procedures to cope with these hazards in an emergency.

Once the plan is completed, it is tested, evaluated and amended as needed on an ongoing basis. To do this, APSS arranges what is known as tabletop exercises, so called because the focal training tool is a tabletop scale map of the community, which helps responders visualize a theoretical emergency. As well, APSS stages live exercises for all communities. In the communities with a hospital, a combined exercise consisting of a simulated accident involving mass casualties gives the community a chance to test two plans at once: its hospital casualty plan and the municipal plan. Mock incidents involving dangerous goods can also be staged to help test a community's response.

Should an emergency or disaster ever occur, these prepared emergency plans and disaster exercises will help first responders be better prepared, which will have a direct effect on mitigating or reducing the risks to life and property.

Another way that APSS helps municipalities manage risk is through training designed to improve the effectiveness and efficiency of a community's response team. One of the duties of a district officer is to identify and recruit candidates in the municipality to attend courses at the APSS Training School in Edmonton, or the Canadian Emergency Preparedness College in Arnprior, Ontario. Courses include topics such as rescue, emergency operations, emergency site management, program management and response to dangerous goods incidents.

District officers also work with local industries, schools and institutions to help them develop emergency plans, and to make sure those plans are co-ordinated with the municipal planning process. In a similar vein, the officers also help municipalities and industries arrange Mutual Aid Agreements with their neighbors so resources can be shared in the event of an emergency or disaster.

Various government grant programs help municipalities acquire necessary emergency response equipment. Through the APSS Rescue Kit Program, for example, more than 200 municipalities have received rescue kits since 1974. To receive a $4,000 kit, which includes a generator and lighting set, air bag kit, wire basket stretchers and other equipment, a municipality must have eight people complete the basic rescue course at the APSS training school, and one of the team must complete the rescue leaders' course.

The Regional Response Improvement Program (RRIP), which is administered by APSS, is designed for cost-sharing projects to help communities improve their emergency response capabilities. Funds can be used for purchasing such things as rescue vehicles, emergency power generators and dangerous goods response equipment, or development of emergency operations centres. Under the program, the municipality shares the cost of the project with the federal and provincial governments. More than $800,000 in RRIP projects have been approved for the current fiscal year. APSS district officers work closely with municipalities to develop their project proposals and follow up to see projects are completed properly.

Through emergency planning activities and grant programs, the Disaster Field Services Branch is applying all but one of the five techniques for reducing risk which are cited in Dr. Shortreed's article on risk management in a technological society (see pg. 5). Those techniques are, namely, to prevent accidents, protect people, respond to accident events and treat the damages to mitigate the risk. The fifth technique, ban the hazard, is outside the branch's mandate.

The public happily accepts the hazards of driving because the benefits appear to outweigh the risks.

GOV'T OF ALBERTA

How the public perceives risk

by Ralph Holmes, Co-ordinator
Industrial Programs

Modern technology has greatly contributed to our way of life today, but it has also brought many new potential hazards, ranging from transportation systems to the disposal of hazardous waste. The public perceives these hazards and risks in many different ways, often without a basis in fact. The study of this phenomenon, where public perception may be markedly different from the objective assessment made by professionals, is known as risk perception.

At one extreme, the public willingly accepts the technological hazard of driving, even though it is a certainty that thousands of people will die in accidents each year, because the benefits appear to outweigh the risks.

At the other extreme is the public's perception of the risk of PCBs, which was most recently witnessed in the public reaction when Quebec tried to ship PCBs from St. Basile-le-Grand to Europe. Public alarm over PCBs is not justified by the scientific information that shows PCBs are somewhat more toxic than table salt. In fact, Walter E. Harris, a professor emeritus at the Univeristy of Alberta and an expert on PCBs, describes them as "political wastes". (See Viewpoint in *Insight*, Vol. 1, No. 3.)

Today, the public is becoming more aware and concerned about dangerous goods, including their manufacture, transportation, storage and disposal. Public attitudes are now an important consideration for anyone involved in any aspect of dangerous goods.

How risk perception is formed

There are many factors which form public opinion concerning risk perception, including such things as the potential size of a possible catastrophe, the risk posed to individuals, and fear of the unknown.

Potential Size of the Catastrophe The size of a possible catastrophe has much to do with the public perception, with a good example being nuclear power generation. While the public may agree that the industry maintains high standards and that an accident is unlikely to occur, people may consider nuclear power unacceptable because the result of any accident could be devastating.

They also remember other accidents such as Chernobyl, and think of the thousands of people killed and injured, not the fact that operating conditions at the plant were not up to North American standards.

Voluntary Versus Involuntary Risks People are more willing to accept a voluntary risk, like hang-gliding, as opposed to being exposed to involuntary risks which are thrust upon them without them being involved in the decision-making process. They believe they have more control over the risks they choose themselves. For this reason, today it is important to consult the public when possible to hear their concerns if they are going to be exposed to a risk as a result of an industrial activity. Public consulta-

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The media provide one source of information, and sometimes misinformation, that helps shape people's perception of risk.

tion and participation is coming to the forefront in many industrial issues such as plant siting.

Individual Risks Individuals apply a different evaluation to an involuntary risk when their own personal safety is involved. In these cases, they will often consider the risk unacceptable because it affects them personally. In contrast, if the risk is to society as a whole, it is often perceived to be more acceptable because individuals tend to believe that if anything is going to happen, it will happen to the other person.

When the risk is personalized, or perceived to put them personally at risk, people are willing to trade off considerable personal benefits to block the risk. At this point, a vocal minority will often surface and sometimes become the focal point for the media.

Familiarity with a Hazard The more familiar people become with a hazard, the more they tend to underestimate it. An example is the public's attitude towards gasoline and propane.

Fear of the Unknown People tend to be apprehensive about unfamiliar things. The longer they do not understand what is involved with a technological system, the greater the chances are that they will grow to fear any potential hazard that is associated with that system. Safety valves used in pressurized systems, for example, produce a loud noise when they lift in order to protect an engineered system, which can lead neighbors to believe they are at risk if they do not understand the device's function.

Emotions The most difficult issues are ones that become charged with emotions. Once opinion concerning any potential hazard reaches this level, much time and energy will be required to change it. Emotions can be played upon by neighbors, special interest groups and by the media.

To prevent an issue from reaching the emotional stage, the public should be continually provided with accurate information through proactive public awareness and educational programs. Public involvement should also be sought when issues affect a community so people's concerns are heard.

Misinformation In some cases, the public evaluation of a potential risk is markedly different from the objective assessment made by specialists. One reason for this difference of opinion may be misinformation, where people base their assessment of a risk on non-factual or incorrect information. Again, misinformation can be prevented with good communications plans.

The Media People form opinions on the basis of their own direct experiences, and they rely on reports from others, including the media, to fill in the gaps in their experiences. Occasionally, media reports can include inaccurate facts or opinions which can lead to public bias.

Perceived risks are real

Perceived risks are real in the minds of people, and it is increasingly recognized that these perceptions must be dealt with whether or not they are based on factual information. It is important, therefore, that both industry and government provide timely, accurate and honest information to the public through a good communications plan, to avoid opinions being formed on misinformation or partial information. The plan should include mechanisms to give the public every opportunity to become involved in decisions affecting their community, and their concerns need to be considered.

Above all, anyone presenting information about potential hazards and their associated risks should take care not to be overconfident. The public will not be reassured to hear that "this could never happen here." Instead, it is more effective to present a plan to give the public confidence that their basic needs would be looked after in the event of an accident.

U of A students in two safety courses attend a number of field trips to see safety and loss management applied by industry.

LAIRD WILSON

U of A program produces safety crusaders

by Laird Wilson, Special Lecturer
Safety and Loss Management,
Faculty of Engineering
University of Alberta (U of A)

Each year in Alberta, almost $2 billion in direct and indirect costs are sustained in industrial losses, including an average of almost 100 deaths in the workplace, 58,000 lost-time injuries, and numerous environmental incidents with associated clean-up costs. Direct costs include $300 million in workers' compensation; indirect costs can involve damage to equipment, production loss, damage to the environment, insurance and retraining.

These are enormous losses to people and businesses. Government, labor and industry are working hard to reduce these losses, with all of them feeling that the progress must be improved. Every person in industry, no matter what job they do, or position they hold, has to be involved and committed to this process. Overwhelming evidence, however, indicates that management commitment and understanding is one of the most significant factors in reducing these losses.

Crusaders in the field

Engineering and business graduates will form a significant portion of our future management. Hence, the object of the Safety and Loss Management Program at the Faculty of Engineering (U of A) is to develop the attitudes and understanding of our graduates so they become crusaders in this field. We believe significant long-term benefits will result.

As we teach it, safety and loss management is a continuous and consistent approach toward the elimination of incidents and the reduction of risks to people, production, equipment and the environment.

In the past, these areas of loss or damage have tended to be treated separately with individual programs. Looking back at major incidents, you can almost always find negative results to people, equipment, production and environment, and all of them are interwoven. Some examples of a major scale are Bhopal, Chernobyl, the North Sea oil rig and the EXXON Valdez. Most large companies are now tending to tackle this whole field with one overall management program. They have, of course, experts in each field with subprograms and objectives, but by designing it as an overall blanket program, the management focus, attention and commitment become greatly increased.

Everything is interconnected

The area of environmental damage is an excellent example of the interconnectedness of all things, and has recently been receiving much heightened and well deserved attention from the public, the media and industry at large. Most environmental incidents either cause, or have the potential to cause, damage to people, company and public assets, and production, in addition to the environmental damage. In our courses, we believe it is important to teach these interconnections. More importantly, we teach the theme of proactive intervention; that is, programs, methods and techniques to prevent "nasty" incidents from happening in the first place.

The program has two fourth-year courses for engineering and business students of all disciplines: Safety and Loss Management is offered in the fall term, and Safety and Risk Management in the winter. Engineering students are taught Design Safety as part of their engineering discipline. Up until quite recently, very little was taught on *operational* safety and loss management to engineering or business students. Some of them gained experience in the area during their summer employment, but most learned in the School of Hard Knocks. As they went into industry, some progressed in their safety and loss management learning, while others did not, depending on the company.

The two courses we provide at the University of Alberta are quite practical in substance. The contents were developed after discussions with a number of high performance companies, appropriate government departments and industry safety associations. Emphasis is placed on basic workplace health and safety, loss control, environmental protection, risk management, effect on the bottom line of industry, and the role of future leaders and managers in this whole field. The winter term course has more emphasis on risk analysis and management, and treats the whole subject in more depth than the broad course in the fall.

Both courses are substantial and complementary, with 34 lectures per course, including some by experts from industry, government and other university faculties such as medicine and business. Five field trips per course are also provided to students to give insight into the application of safety and loss management in the field. Case studies and team projects are carried out on such topics as Bhopal, Flixborough, Lodgepole, power blackouts, oil rig disasters, etc., including both the loss prevention and business aspects.

Teaching the right attitude

It is our object, with appropriate funding being made available, to expand the program and establish a chair in safety and loss management. We can then expand our teachings to undergraduate and graduate students, provide seminars, do appropriate research, co-operate with the faculties of business and medicine in project work, and become a centre of excellence in safety and loss management, all to benefit students, workers, industry, government and the public.

We believe that teaching the right attitude and commitment to safety and loss management to our engineering and business students is of particularly high importance. It will pay off in the long run as they take up positions of management and leadership in industry.

Product Profile

Batteries

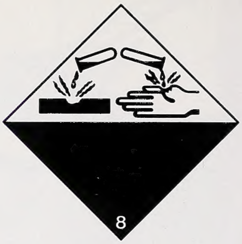
Most people don't realize that the batteries used to run their cars can actually be quite dangerous. In fact, electric storage batteries, including those found in automobiles, are classified and regulated as dangerous goods when being transported. (They are not, however, regulated as dangerous goods while under the hood of a car. Dry cell batteries, which are used for many household purposes, are also not regulated as dangerous goods.)

Batteries use a strong acid or alkali to generate the electricity and it is these chemicals which make the battery a dangerous good. The most common acid used is sulphuric acid at a strength of 24 per cent sulphuric acid in water, which is a highly corrosive liquid.

The most common battery, which is filled with sulphuric acid, is the one used in automobiles. Anyone involved in boosting a car with a dead battery should make sure that the two batteries are connected positive to positive and negative to negative. If the two batteries are not connected in the correct manner, one of the two may explode, showering anyone nearby with sulphuric acid. The charging of a wet battery produces hydrogen, a highly flammable gas. Care should be taken, when charging, to ensure good ventilation and that no naked flames are present.

If an automobile battery is involved in an accident and the acid is spilled, it must be contained so it does not spread. The spilled product can be neutralized using soda ash or lime and then flushed with a generous amount of water. If skin or eyes come into contact with the acid, the contaminated area should be rinsed under running water for at least 15 minutes, and then medical help should be obtained.

Batteries are also used in a number of other ways: they can be placed in circuit together for storage of electricity in the event of power failure, and large batteries are often used to power industrial machinery, such as electric forklifts used in warehouses.



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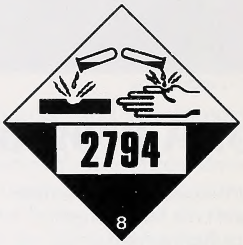

Required Placard for Batteries, wet, filled with acid, electric, storage *(For batteries, wet, filled with alkali, electric, storage, the UN number to be displayed is 2795; for battery fluid, acid, the UN number is 2796; for battery fluid, alkali, the UN number is 2797.)*

Because of the dangers related to batteries, these products must be transported in compliance with the Transportation of Dangerous Goods regulations. (The exception is wet batteries, which may not be shipped as a consumer commodity but are exempt from the regulations when being transported from a retail outlet to their point of use, or the residence of the purchaser.)

All packaging containing batteries must have all the correct safety marks, including the United Nations identification number, the proper shipping name and label indicating a corrosive product. The two names that batteries are generally shipped under are "Batteries, wet, filled with acid", UN 2794, and "Batteries, wet filled with alkali", UN 2795. There are two other shipping names that are applicable, Battery fluid, acid, UN 2796, and Battery fluid, alkalis, UN 2797, which are listed for the movement of the fluid with or without an empty battery case. The shipments of these commodities would require full dangerous goods documentation, and for loads exceeding 500 kgs (1,100 lbs.), placards would have to be displayed on all sides of the transport vehicle.

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Risk Assessment/Awareness/Management: A selected bibliography of materials available from the Alberta Public Safety Services Library

Compiled by Teresa Richey,
APSS Librarian

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Environmental Health Risks: Assessment and Management. Edited by R. Stephen McColl. Waterloo, Ont. : University of Waterloo Press, 1987. 324 p.
RA 566 .E59, MAIN LIBRARY

Emphasizes the management of toxic chemicals released into the environment or enountered as occupational hazards. Analyses the components of risk analysis, namely hazard identification, and risk estimation, evaluation and management. Illustrates inter-relationships between components. Broad overviews are provided for each as well as narrower research papers. Includes bibliographies.

Fernstermacher, T. Edward, et. al. **A Manual for Performing Transportation Risk Assessment.** Washington, D.C. : Chemical Manufacturers Association, 1987. Various pagings.
HE 199.5 .C53 F47, MAIN LIBRARY

Discusses the specific application of risk analysis to transportation. Outlines procedures for generating risk curves and interpreting results. Addresses the issue of comparing risks. Examples provided. Includes references.

Managing Technological Hazard: Research Needs and Opportunities. Edited by Robert W. Kates. Boulder, Colo. : Institute of Behavioral Science, 1977. (Program on Technology, Environment and Man Monograph 25), 169 p.
T 174.5 .M36, MAIN LIBRARY

A selection of papers synthesized from a series of workshops conducted in early 1977. Intention is to identify trends in hazard management and outline major research opportunities and needs. Included are background papers from the workshops on hazard identification, communication of risk and risk evaluation.

Morone, Joseph G. and Edward J. Woodhouse. **Averting Catastrophe: Strategies for Regulating Risky Technologies.** Berkeley, Ca. : University of California Press, 1986. 215 p.
T 174.5 .M68, MAIN LIBRARY

Probes the question of how we avoid catastrophies when engaging in risky technological activities. Five types of technological risks; toxic chemicals, nuclear power, recombinant DNA research, threats to the ozone layer and the greenhouse threat are scrutinized from the point of view of how regulators make decisions on risk. Strategies currently in use are discussed and an integrated catastrophe-aversion system is proposed. Intended for a broad audience from the lay person to policy makers, scientists, engineers and risk analysts.

Nudell, Mayer and Norman Antokol. **The Handbook for Effective Emergency and Crisis Management.** Lexington, Ma. : Lexington Books, 1988. 192 p.
HD 49 .N83, MAIN LIBRARY

Risk assessment is addressed within the context of emergency and crisis management. By properly evaluating risk, many emergencies or crises can be avoided. Checklists are provided, as well as a means for integrating risk assessment into an emergency plan.

Perspectives on Increasing Hazard Awareness. Edited by Thomas F. Saarinen. Boulder, Colo. : Institute for Behavioral Science, 1982. (Program on Environment and Behavior Monograph 35), 138 p.
HV 553 .P47, MAIN LIBRARY

Summary of a workshop held in Corpus Christi, Texas, March 22-23, 1979. Basic assumptions on the role of public education in teaching awareness are explored and a survey of existing hazard awareness programs is given. Relationships between hazard awareness and resulting social behavior are addressed in order to underline both the importance and limitations of public awareness. A plan for developing a public information program is introduced.

Risk Analysis Controversy: An Institutional Perspective. Proceedings of a Summer Study on Decision Processes and Institutional Aspects of Risk held at IIASA, Laxenburg, Austria, June 22-26, 1981. Edited by Howard C. Kunreuther and Eryl V. Ley. Berlin : Springer-Verlag, 1982. 236 p.
T 174.5 .R554, MAIN LIBRARY

Various aspects of the debate on the meaning and importance of risk analysis are presented. Focuses on the problem of events or technological advances that are of potential benefit to individuals or society but also come with environmental, health and safety risks attached. The difficulty in assigning weight to a risk, the limited statistical data available for assigning risk and the dynamic sequential affect of decision-making on the perceived risk are discussed. Includes bibliographies.

Risk Analysis in the Process Industries: Report of the International Study Group on Risk Analysis. By the European Federation of Chemical Engineering. Rugby, Eng. : Institute of Chemical Engineers, 1985. 92 p.
T 55 .E97 c.1-2, MAIN LIBRARY

With the increased interest expressed in risk analysis for plant processes came a need to clarify and standardize approaches. The study group defines and summarizes risk analysis. Basic principles, procedures and applications are outlined for risk identification, consequence analysis, and event probabilities and risk. Strengths and limitations of the techniques are summarized, as are final conclusions and recommendations for application. Includes models.

Risk Assessment and Management: Emergency Planning Perspectives. Edited by Larry R.G. Martin and Gilbert Lafond. Waterloo, Ont. : University of Waterloo Press, 1988. 352 p.
HV 553 .R58 c.1-4, MAIN LIBRARY

Stock, Richard G. and Sharon E. Lefroy. **Risk Management: A Practical Framework for Canadian Health Care Facilities.** Ottawa, Ont. : Canadian Hospital Association, 1988. 224 p.
RA 971.38 .S86 1988, HEALTH

Technological Risk. Proceedings of a Symposium on Risk in New Technologies. First University Symposium, Dec. 15, 1981, University of Waterloo. Edited by N.C. Lind. Waterloo, Ont. : University of Waterloo Press, 1982. 185 p.
T 174.5 .S96, MAIN LIBRARY

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